

*REMARKS/ARGUMENTS**The Pending Claims*

The pending claims are directed to chemical-mechanical polishing compositions. Claims 1-10, 14-31, and 35-42 currently are pending. Reconsideration of the pending claims is respectfully requested.

Summary of the Office Action

Claims 1-10, 14-31, and 35-42 stand rejected under 35 U.S.C. § 103(A) as allegedly unpatentable over U.S. Patent Application Publication 2001/0006224 A1 (Tsuchiya et al.) (hereinafter “the Tsuchiya ‘224 publication”).

Discussion of the Obviousness Rejection

The Office Action repeats its rejection of claims 1-10, 14-31, and 35-42 as obvious over the disclosure of the Tsuchiya ‘224 publication. In its rejection of the pending claims, the Office Action asserts that Applicants have failed to present sufficient evidence of unexpected results attendant the use of a polishing composition comprising 2.5×10^{-2} to about 2.5 mmoles/kg of calcium, about 1×10^{-2} to about 1.5 mmoles/kg of strontium, or about 7×10^{-3} to about 0.75 mmoles/kg of barium when used to polish substrates comprising tantalum.

For subject matter defined by a claim to be considered obvious, the Office must demonstrate that the differences between the claimed subject matter and the prior art “are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” 35 U.S.C. § 103(a); see also *Graham v. John Deere Co.*, 383 U.S. 1, 148 U.S.P.Q. 459 (1966). The ultimate determination of whether an invention is or is not obvious is based on certain factual inquiries including: (1) the scope and content of the prior art, (2) the level of ordinary skill in the prior art, (3) the differences between the claimed invention and the prior art, and (4) objective evidence of nonobviousness. *Graham*, 383 U.S. at 17-18, 148 U.S.P.Q. at 467.

1. *Scope and Content of the Prior Art*

The Tsuchiya '224 publication recites 48 metal cations, plus ammonium ion, as suitable components of the inorganic salts for the polishing composition of the Tsuchiya '224 publication. While calcium, strontium, and barium are included among these many possible cations, the Tsuchiya '224 publication provides no teaching or suggestion that would lead one of ordinary skill in the art, at the time of the present invention, to select calcium, strontium, or barium over the other available choices. Rather, the Tsuchiya '224 publication teaches that preferable salts are ammonium and potassium salts (Tsuchiya '224 publication at paragraph 0037).

The Tsuchiya '224 publication teaches that the polishing composition disclosed therein must contain at least 0.01 wt.%, and preferably contains at least 0.05 wt.%, of the inorganic salt (Tsuchiya '224 publication at paragraph 0040). There is nothing within the Tsuchiya '224 publication that would lead one of ordinary skill in the art, at the time of the present invention, to use an appropriate inorganic salt in an amount that would provide (a) about 2.5×10^{-2} to about 2.5 mmol/kg of calcium (i.e., about 0.0001 to about 0.01 wt.% calcium), (b) about 1×10^{-2} to about 1.5 mmol/kg of strontium (i.e., about 0.000088 to about 0.0088 wt.% of strontium), or (c) about 7×10^{-3} to about 0.75 mmol/kg of barium (i.e., about 0.000069 to about 0.01 wt.% of barium), as required by the pending claims.

2. *Level of Ordinary Skill in the Art*

For the purposes of the present argument, one of ordinary skill in the art can be treated as someone with an advanced chemistry degree and at least a few years of experience in the field of chemical-mechanical polishing of substrates.

3. *Differences Between Claimed Invention and Prior Art*

In order to arrive at the present invention as defined by the pending claims, one of ordinary skill in the art, at the time of invention, would have had to ignore the stated preference of the Tsuchiya '224 publication for ammonium and potassium salts (and instead chose a salt to provide calcium, strontium, or barium as recited in the pending claims) and ignore the disclosure to use at least 0.01 wt.%, and preferably at least 0.05 wt.%, inorganic

salt (and instead chose to use a sufficient amount of an inorganic salt to provide the concentration of calcium, strontium, or barium recited in the pending claims).

4. *Objective Evidence of Unobviousness*

Applicants previously presented data demonstrating the unexpected results attendant the use of calcium, strontium, and barium in the polishing of tantalum metal (see "Response to Office Action" dated March 26, 2007). The Office Action alleges that Applicants have not presented a sufficient amount of data to establish that the claimed polishing composition exhibits unexpected properties when used to polish substrates comprising tantalum, and that Applicants need to present sufficient data to establish a showing of unexpected results for each of calcium, strontium, and barium relative to the other cations recited in the Tsuchiya '224 publication.

Contrary to the Office Action's allegations, Applicants have established that polishing compositions comprising calcium, strontium, and barium exhibit unexpected results when used to polish substrates comprising tantalum in comparison to aluminum (a Group IIIA metal), magnesium (an alkaline earth metal), and the transition metals titanium, zirconium, and iron, which are representative members of the metal cations disclosed in the Tsuchiya '224 publication. Example 1 of the present specification demonstrates that a polishing composition comprising calcium exhibits tantalum removal rates which are 5.9 to 7.6 times greater than those observed for polishing compositions comprising aluminum, magnesium, titanium, zirconium, and iron, at similar or even higher concentrations of the comparative metals. Example 4 demonstrates that polishing compositions comprising 1.0 mmoles/kg of calcium, 0.46 mmoles/kg of strontium, and 0.29 mmoles of barium exhibited tantalum removal rates that were essentially the same and were 7.1 times, 6.9 times, and 6.4 times the tantalum removal rates observed for a control polishing composition, despite different concentrations of the metals in the polishing compositions, thereby supporting the conclusion that strontium and barium exhibit unexpectedly high tantalum removal rates similar to that observed for calcium in comparison to aluminum, magnesium, titanium, zirconium, and iron.

Furthermore, Example 1 of the present specification demonstrates that salts of magnesium, which along with calcium, strontium, and barium is an alkaline earth metal, do

not provide enhanced removal rates when used to polish substrates comprising tantalum as do salts of calcium, strontium, and barium. In particular, a polishing composition containing 0.50 mmol/kg of calcium exhibited a tantalum removal rate of 608 Å/min, whereas a polishing composition containing 0.82 mmol of magnesium exhibited a tantalum removal rate of only 113 Å/min. Together with the results set forth in Example 4 of the present specification, which demonstrate the enhanced removal rates exhibited by polishing compositions comprising calcium, strontium, and barium, these unexpected results obtained using polishing compositions comprising calcium, strontium, and barium, but not magnesium, another alkaline earth metal, provide further support for the nonobviousness of the present invention as recited in the pending claims.

Moreover, the Office Action acknowledges that the rate of removal of tantalum varies depending upon both the particular type of cation included in the polishing composition, as well as the concentration of the cation in the polishing composition. This is a reason why the pending claims recite different concentration ranges for calcium, barium, and strontium. Nothing within the Tsuchiya '224 publication teaches or suggests that the tantalum removal rate exhibited by polishing compositions comprising any of the 48 metal cations, as well as ammonium ion, disclosed therein, depends on the particular metal cation *or* the concentration of the metal cation in the polishing composition. This observation, provided by the present application, provides further evidence of the nonobviousness of the subject matter recited in the pending claims.

5. *Consideration of Graham Factors Together*


In view of the foregoing comments concerning each of the *Graham* factors, Applicants respectfully submit that the subject matter defined by the pending claims is unobvious over the disclosure of the Tsuchiya '224 publication and that the obviousness rejection should be withdrawn.

Conclusion

Applicants respectfully submit that the patent application is in condition for allowance. If, in the opinion of the Examiner, a telephone conference would expedite the

prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,



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